Message

**From:** Jennings, Eleanor [Eleanor.Jennings@parsons.com]
**Sent:** 5/22/2019 5:05:37 PM
**To:** Pearson, Stuart C. [stuart.pearson@woodplc.com]; Smallbeck, Donald R. [donald.smallbeck@woodplc.com]; D'Almeida, Carolyn [dAlmeida.Carolyn@epa.gov]; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' [catherine.jerrard@us.af.mil]; 'Wayne Miller' [Miller.Wayne@azdeq.gov]
**CC:** d p [DPope@css-dynamac.com]; Davis, Eva [Davis.Eva@epa.gov]; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP [gregory.gangnuss@us.af.mil]; Nicole Goers [Nicole.Goers@TechLawInc.com]; 'Brasaemle, Karla' [KBrasaemle@TechLawInc.com]; 'Rohrbaugh, Amanda' [ARohrbaugh@TechLawInc.com]; 'Bo Stewart' [bo@praxis-enviro.com]; William Hughes [William.Hughes@cn-bus.com]; 'steve@uxopro.com' [steve@uxopro.com]; 'Panzino.Paula@azdeq.gov' [Panzino.Paula@azdeq.gov]
**Subject:** RE: ST012 Site Activities

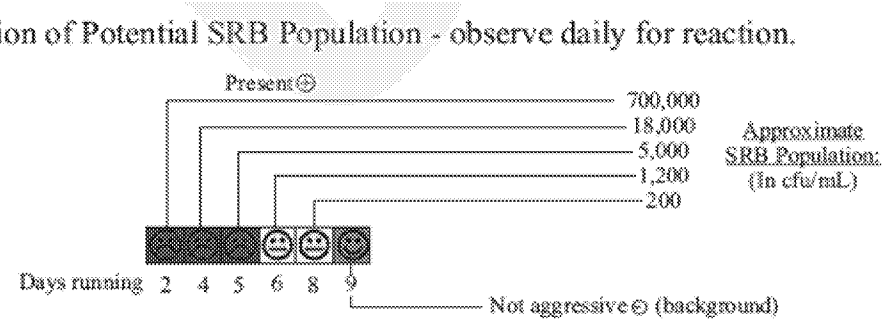
Sensitive / Proprietary

Hi Stu,
Thanks for getting back to me about this question, and for responding so promptly.

So, I pulled up the three different SRB-BART documents that I found from the manufacturer, and I think I found the source of the difference between what you all were looking at and what I was looking at.

**COMPARISON OF POPULATION ESTIMATE TABLES**

**Document 1.** This is a little two-page document that has abridged directions for analysis use and evaluation. It provides the following table for interpretation, along with these cartoon frowny-faces and smiley-faces. Since the tests were designed to evaluate SRBs in drinking water and waste-water systems, higher SRB populations are not desirable and thus the frowny-faces and vice-versa.




**Document 2.** This is a 57-page document produced by the test manufacturer, detailing all of their various BART tests, including the one for SRBs. The estimated population sizes match the values provided above in Document 1.

**Table Four**

**The Relationship between Time Lag and the Population For Sulfate Reducing Bacteria**

| Time Lag (days) | Population cfu/ml |
|---|---|
| 1 | 6,800,000 |
| 2 | 700,000 |
| 3 | 100,000 |
| 4 | 18,000 |
| 5 | 5000 |
| 6 | 1200 |
| 7 | 500 |
| 8 | 200 |

**Document 3.** This is a four-page document that looks like something that would accompany the test kits, to be used by personnel actually conducting the tests. This is the document that Wood referenced, and it provides the following table:

**Table 1 Approximate bacteria population**

| Days to reaction | Approximate SRB population (cfu/mL) | Aggressivity |
|---|---|---|
| 1 | 2,200,000 | Very high |
| 2 | 500,000 | High |
| 3 | 115,000 | High |
| 4 | 27,000 | High |



**Table 1 Approximate bacteria population (continued)**

| Days to reaction | Approximate SRB population (cfu/mL) | Aggressivity |
|---|---|---|
| 5 | 6000 | Moderate |
| 6 | 1400 | Moderate |
| 7 | 325 | Moderate |
| 8 | 75 | Low |

However, please note that the reported population sizes in **Document 3** are not the same as those provided in the tables from the first two documents.

**DISCUSSION**

Per the above, it's apparent that you all were working off of values provided in Document 3. However, during the BCT call yesterday, I was looking at the other two documents. So, in a way, we were both correct.

The fact that the manufacture's population estimate tables are not in alignment with each other was not expected. However, it seems to underscore the fact that these tests were meant to be qualitative. At best, orders of magnitude differences in population sizes can be inferred. I talked with the manufacturer again, and they confirmed this.

As stated during the 5/21/19 BCT call, these tests are a very appropriate, cost-effective, preliminary screening method for sulfate-reducing bacteria. True quantitative population sizes can then be determined with the use of the more expensive, but much more precise, qualitative polymerase chain reaction (qPCR) assessments that are planned.

**SUGGESTION**

Since the slides for the BCT meetings are part of the administrative record for the site, I would suggest clearly stating on the slide that any reported population sizes obtained by the SRB-BART tests are only to suggest order of magnitude differences and that they are not truly quantitative. Just a simple statement of what procedure/test method used would remove confusion (by somebody looking at these slides in the future, for example) with data provided by truly quantified analyses. This would more accurately reflect how to properly interpret the data.

Kind regards,
Eleanor

**Eleanor M. Jennings, M.S., PhD**
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202.302.9996

"Safety Isn't Expensive. It's Priceless."

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**From:** Pearson, Stuart C. <stuart.pearson@woodplc.com>
**Sent:** Wednesday, May 22, 2019 9:56 AM
**To:** Smallbeck, Donald R. <donald.smallbeck@woodplc.com>; D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>
**Cc:** d p <DPope@css-dynamac.com>; Davis, Eva <Davis.Eva@epa.gov>; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP <gregory.gangnuss@us.af.mil>; Nicole Goers <Nicole.Goers@TechLawInc.com>; 'Brasaemle, Karla' <KBrasaemle@TechLawInc.com>; 'Rohrbaugh, Amanda' <ARohrbaugh@TechLawInc.com>; 'Bo Stewart' <bo@praxis-enviro.com>; William Hughes <William.Hughes@cn-bus.com>; 'steve@uxopro.com' <steve@uxopro.com>; Jennings, Eleanor <Eleanor.Jennings@parsons.com>; 'Panzino.Paula@azdeq.gov' <Panzino.Paula@azdeq.gov>
**Subject:** RE: ST012 Site Activities

A question came up on yesterday's BCT call concerning the source of the numerical values for the field SRB results. To clarify, this information was taken from the manufacturer's literature that came with the test kits and that Don provided as an attachment in his email below. It is also available on the Hach web site https://www.hach.com/asset-get.download.jsa?id=16716485755 [hach.com] . I've highlighted and pasted the relavant information below. You can see that we observed the reaction at about three days for UWBZ27 and between six and seven days for LSZ39 (the precipitate formed overnight between days). The precision of this test is limited and should only be viewed as semi-quantitative.

Stu

Table 1 Approximate bacteria population

| Days to reaction | Approximate SRB population (cfu/mL) | Aggressivity |
|---|---|---|
| 1 | 2,200,000 | Very high |
| 2 | 500,000 | High |
| 3 | 115,000 | High |
| 4 | 27,000 | High |



Table 1 Approximate bacteria population (continued)

| Days to reaction | Approximate SRB population (cfu/mL) | Aggressivity |
|---|---|---|
| 5 | 6000 | Moderate |
| 6 | 1400 | Moderate |
| 7 | 325 | Moderate |
| 8 | 75 | Low |

**From:** Smallbeck, Donald R.
**Sent:** Thursday, May 9, 2019 2:34 PM
**To:** D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>; Pearson, Stuart C. <stuart.pearson@woodplc.com>
**Cc:** d p <DPope@css-dynamac.com>; Davis, Eva <Davis.Eva@epa.gov>; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP <gregory.gangnuss@us.af.mil>; Nicole Goers <Nicole.Goers@TechLawInc.com>; 'Brasaemle, Karla' <KBrasaemle@TechLawInc.com>; 'Rohrbaugh, Amanda' <ARohrbaugh@TechLawInc.com>; 'Bo Stewart' <bo@praxis-enviro.com>; William Hughes <William.Hughes@cn-bus.com>; 'steve@uxopro.com' <steve@uxopro.com>; 'Jennings, Eleanor' <Eleanor.Jennings@parsons.com>; 'Panzino.Paula@azdeq.gov' <Panzino.Paula@azdeq.gov>
**Subject:** RE: ST012 Site Activities

Please find attached the field test screening information.

The results to date are

UWBZ27 $1.15 \times 10^5$ cfu/ml

LSZ39 325 to 1400 cfu/ml

cfu=colony forming units

**From:** D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>
**Sent:** Thursday, May 09, 2019 10:47 AM
**To:** Smallbeck, Donald R. <donald.smallbeck@woodplc.com>; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>; Pearson, Stuart C. <stuart.pearson@woodplc.com>
**Cc:** d p <DPope@css-dynamac.com>; Davis, Eva <Davis.Eva@epa.gov>; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP <gregory.gangnuss@us.af.mil>; Nicole Goers <Nicole.Goers@TechLawInc.com>; 'Brasaemle, Karla'

<KBrasaemle@TechLawInc.com>; 'Rohrbaugh, Amanda' <ARohrbaugh@TechLawInc.com>; 'Bo Stewart' <bo@praxis-enviro.com>; William Hughes <William.Hughes@cn-bus.com>; 'steve@uxopro.com' <steve@uxopro.com>; 'Jennings, Eleanor' <Eleanor.Jennings@parsons.com>; 'Panzino.Paula@azdeq.gov' <Panzino.Paula@azdeq.gov>
**Subject:** RE: ST012 Site Activities

Thanks Don

Can you tell us what the name/manufacturer of field test kit you are using for sulfate reducers, and compilation of data you have so far for each of the wells?

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Federal Facilities Branch (SFD 8-1)
US EPA Region 9 Laboratory
1337 South 46th Street, Building 201
Richmond, CA 94804
(415) 972-3150

*"We can evade reality, but we cannot evade the consequences of evading reality." - Ayn Rand*

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**From:** Smallbeck, Donald R. <donald.smallbeck@woodplc.com>
**Sent:** Wednesday, May 8, 2019 2:07 PM
**To:** D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>; Pearson, Stuart C. <stuart.pearson@woodplc.com>
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**Subject:** RE: ST012 Site Activities

Carolyn

It is a field screening test kit performed by Wood personnel which has been described in previous BCT presentations. There is no specific report other than the test kit results. I will provide the information associated with the kits in a separate email.

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**From:** D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>
**Sent:** Wednesday, May 08, 2019 2:03 PM
**To:** Smallbeck, Donald R. <donald.smallbeck@woodplc.com>; 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>; Pearson, Stuart C. <stuart.pearson@woodplc.com>
**Cc:** d p <DPope@css-dynamac.com>; Davis, Eva <Davis.Eva@epa.gov>; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP <gregory.gangnuss@us.af.mil>; Nicole Goers <Nicole.Goers@TechLawInc.com>; 'Brasaemle, Karla' <KBrasaemle@TechLawInc.com>; 'Rohrbaugh, Amanda' <ARohrbaugh@TechLawInc.com>; 'Bo Stewart' <bo@praxis-enviro.com>; William Hughes <William.Hughes@cn-bus.com>; 'steve@uxopro.com' <steve@uxopro.com>; 'Jennings, Eleanor' <Eleanor.Jennings@parsons.com>; 'Panzino.Paula@azdeq.gov' <Panzino.Paula@azdeq.gov>
**Subject:** RE: ST012 Site Activities

Can we get the field screening data reports indicating presence of sulfate reducers referenced below?
Thank you.

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*"We can evade reality, but we cannot evade the consequences of evading reality." - Ayn Rand*

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**From:** Smallbeck, Donald R. <donald.smallbeck@woodplc.com>
**Sent:** Wednesday, May 8, 2019 1:47 PM
**To:** 'JERRARD, CATHERINE V CIV USAF HAF AFCEC/CIBW' <catherine.jerrard@us.af.mil>; 'Wayne Miller' <Miller.Wayne@azdeq.gov>; D'Almeida, Carolyn <dAlmeida.Carolyn@epa.gov>; Pearson, Stuart C. <stuart.pearson@woodplc.com>
**Cc:** d p <DPope@css-dynamac.com>; Davis, Eva <Davis.Eva@epa.gov>; GANGNUSS, GREGORY G GS-14 USAF HAF AFCEC/CIBP <gregory.gangnuss@us.af.mil>; Nicole Goers <Nicole.Goers@TechLawInc.com>; 'Brasaemle, Karla' <KBrasaemle@TechLawInc.com>; 'Rohrbaugh, Amanda' <ARohrbaugh@TechLawInc.com>; 'Bo Stewart' <bo@praxis-enviro.com>; William Hughes <William.Hughes@cn-bus.com>; 'steve@uxopro.com' <steve@uxopro.com>; 'Jennings, Eleanor' <Eleanor.Jennings@parsons.com>; 'Panzino.Paula@azdeq.gov' <Panzino.Paula@azdeq.gov>
**Subject:** ST012 Site Activities

Activities through last week (5/03)

- SVE Operation
- LNAPL checks
- CZ21 repaired with new motor
- Continued extraction and treatment ~50 gpm, ~17.5 million total gallons treated since startup of EBR extraction.
- Operating Extraction Wells: CZ07, CZ21, UWBZ21, UWBZ26, UWBZ27, UWBZ30, LSZ09, LSZ11, LSZ12, LSZ23, LSZ37, LSZ38, LSZ39
- Extraction Wells Down: CZ18, UWBZ22
- CZ07 pumping at approximately 14 gpm.
- Started quarterly GW sampling (except for extraction wells still to be repaired)
- Injections:
    - UWBZ35: 3 tons 4/8, ~1 ton 4/9, 0.7 tons 4/10, 2.7 tons 4/12
    - LSZ08: 2 tons 4/9, 1.3 tons 4/10, 2.3 tons 4/12, 3 tons 4/17, 5 tons 4/18, 2.6 tons 4/25
    - LSZ47: 0.4 tons 4/25, 3 tons 4/26, 4.3 tons 4/29,
    - LSZ48: 5 tons 4/30, 2.5 tons 5/1
    - LSZ49: 3.5 tons 5/1, 2 tons 5/3
- Sulfate screening at LZS39 indicates that the sulfate concentration has achieved breakthrough, is in a range for EBR to commence, (approximately 1,000 mg/L and extraction was stopped on May 2 for aquifer re-equilibration. Field screening (semi-quantitative) of sulfate reducers after pumping was stopped (approximately 7 days) indicated a low level population is present. Approximately 10-14 days after extraction ceases, a Time 0 groundwater sample will be collected to establish a VOCs and inorganic parameter profile.
- Sulfate screening at UWBZ27 indicates that sulfate concentration has achieved breakthrough, is in range for EBR to commence, (approximately 1,000 mg/L and extraction was stopped on May 2 for aquifer re-equilibration. Field screening (semi-quantitative) of sulfate reducers after pumping had stopped (approximately 7 days) indicated a robust population of approximately $1x10^5$ is present. Approximately 10-14 days after extraction ceases, a Time 0 groundwater sample will be collected to establish a VOCs and inorganic parameter profile.

This week (5/6-5/10)

- SVE Operation
- Continue extraction
- LNAPL checks
- CZ07 repair (went down 5/7, repair scheduled 5/9)
- Continue quarterly GW sampling
- Continue injecting sulfate

Next Week (5/13-5/17)

- SVE Operation
- LNAPL checks
- Continue extraction
- Repair CZ18 and UWBZ22
- Continue Injecting sulfate
- Time 0 sampling at LSZ39 and UWBZ27

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